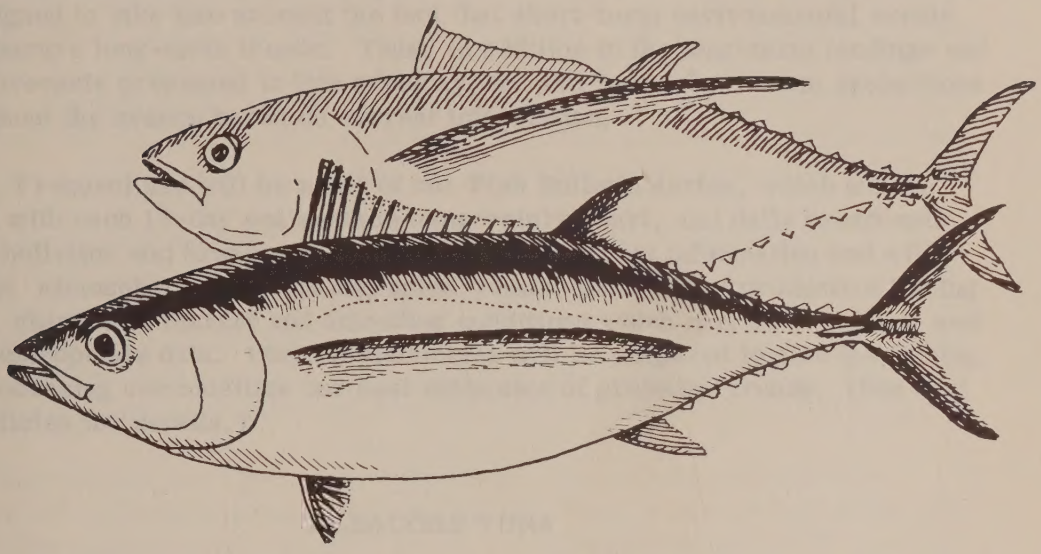
FISHING INFORMATION

MAY 1970



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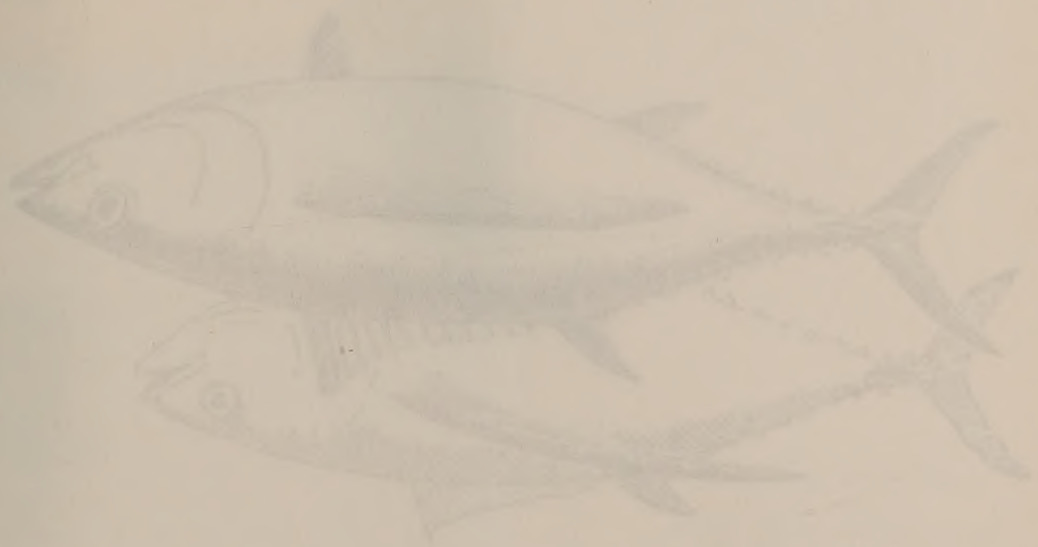
UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF COMMERCIAL FISHERIES
FISHERY-OCEANOGRAPHY CENTER
LA JOLLA, CALIFORNIA



FISHING INFORMATION

TEMPERATE TUNA FORECAST FOR 1970

This is the 10th annual advisory to be issued for the albacore and bluefin tuna fisheries off the North American Coast. Our pattern of operations this year is designed to take into account the fact that short-term environmental events may obscure long-term trends. Thus, in addition to the long-term landings and area forecasts presented in this advisory, we will issue short-term projections throughout the season based on current information.

Frequent use will be made of our Fish Bulletin series, which will be issued with each 15-day sea surface temperature chart, and daily broadcasts. These bulletins and broadcasts will update our forecast information and will include: atmospheric and oceanographic trends, locations of productive fishing areas, changes in market and unloading conditions which may affect effort, and other appropriate data. Outlook statements will be prepared to give the fishing and processing communities our best estimates of projected trends. (See next two articles for details.)

ALBACORE TUNA

Based on (1) the warmer than average ocean temperatures in waters off the Pacific Northwest; (2) the position of the 60° F isotherm offshore; and (3) the historical record of landings, it would appear that the albacore fishery will be centered again this year in waters off the Pacific Northwest. We estimate that between 26-40 million pounds will be landed in Oregon, Washington, and British Columbia, and between 11-15 million pounds will be landed in California, based on current trends and historical analysis.

The high correlation between catch and sea surface temperature shows that albacore tuna seem to prefer ocean temperatures in the range of 60-66° F. Historically, most albacore taken in waters off California have been caught in waters between 62-66° F with highest catches made in 64° F water. According to preliminary research results obtained by Oregon State University using data gathered during the 1969 albacore season for fish caught in waters off the Pacific Northwest, the average sea surface temperature in areas from which albacore were taken in July and August was about 62° F; for albacore caught in September, it was about 60° F. No commercial quantities of albacore were taken from waters off the Pacific Northwest colder than 58° F or warmer than 64.5° F.

At present, sea surface temperatures in the northeast Pacific south of 40° N are in general slightly cooler than the 10-year average, whereas, north of 40° N the sea surface temperatures are about 1° F above the average. The position of the 60° F isotherm for the period May 16-31, 1970 (solid line) and the 9-year average (1961-1969) position of this isotherm (dashed line) are shown in Plate 1. It appears that early-season warming has already started the northeastward advance of the 60° F isotherm in the area west of longitude 130° W and shoreward of longitude 125° W. However, the northerly advance of the 60° F isotherm is lagging slightly behind the 9-year average between longitudes 120-130° W. During April and May there was stronger than average northerly wind flow over this latter region causing increased cooling by evaporation and increased southward flow of the cool California Current.

The 10-year average position (1960-1969) of the optimum-temperature zone for albacore for the July 1-15 period is shown in the shaded portion of Plate 2. If this period in 1970 is "average", the bulk of albacore will be taken from this zone. However, prevailing weather during this period may cause deviations from this general pattern. We plan to modify and update our projection of the location of the properties affecting albacore distribution as conditions indicate.

During this past winter, the dominant feature of the weather pattern over the North Pacific was a considerably deeper than normal Aleutian low pressure system. This condition produced a strong cyclonic (counterclockwise) wind pattern with resultant widespread cooling in the central North Pacific and less than average winter cooling in the eastern North Pacific. Thus, higher than normal sea surface temperatures existed in a large region off the northern U. S. and Canadian west coasts. Beginning in mid-March, the North Pacific high pressure system increased in intensity and size, dominating the weather pattern off the Pacific Northwest. Abnormally high pressures prevailed throughout April and continued to a lesser degree in May. The increased winds in April associated with this high pressure system were predominantly from the north and north-northwest along the Oregon and California Coasts. These winds caused intense upwelling forming a band of cooler than normal and nutrient-rich water in these regions.

During May a pressure ridge extending northeastward from the North Pacific high pressure system reduced winds offshore Vancouver Island and the Washington Coast. The seasonal increase in solar radiation and a decrease in heat loss from the sea surface contributed to the persistence of the warm ocean temperatures created earlier.

According to information supplied by the Extended Forecast Division of the U.S. Weather Bureau, the sea-level pressure pattern over the eastern North Pacific is expected to be close to normal for the month of June. However, anticipated higher than average temperatures over inland California may result in

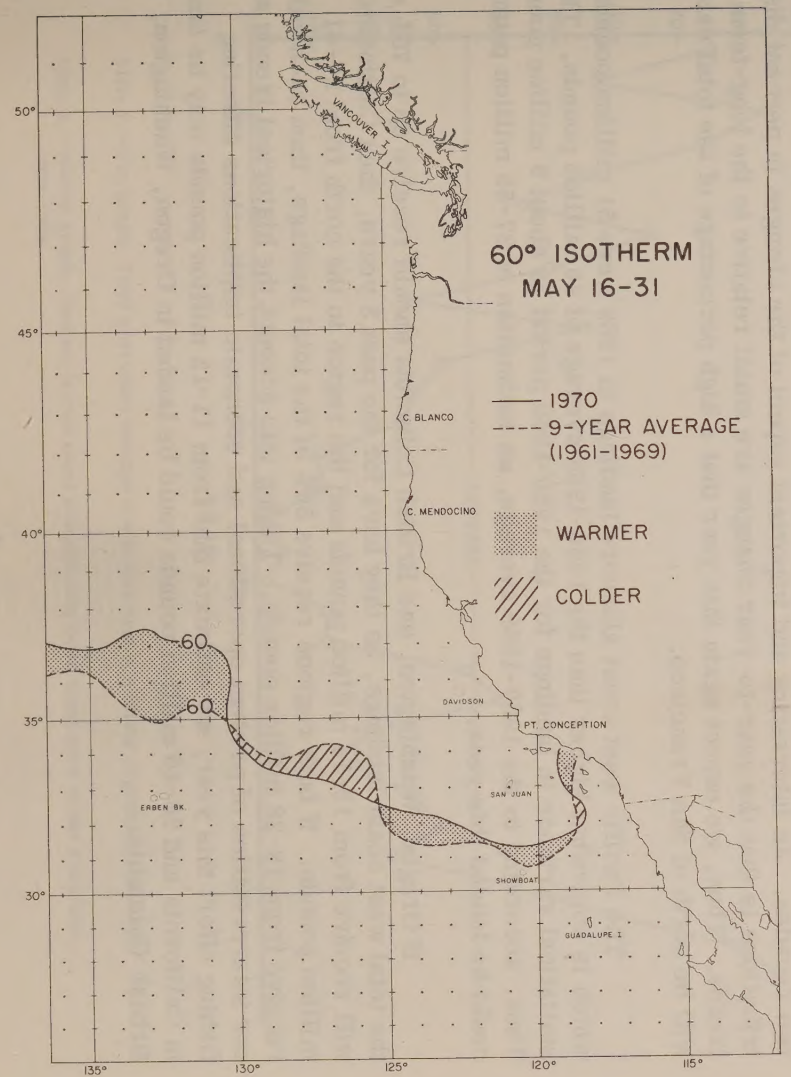


Plate 1.--Relation of position of May 16-31, 1970, 60° F limiting isotherm to long-term average position for the same interval.

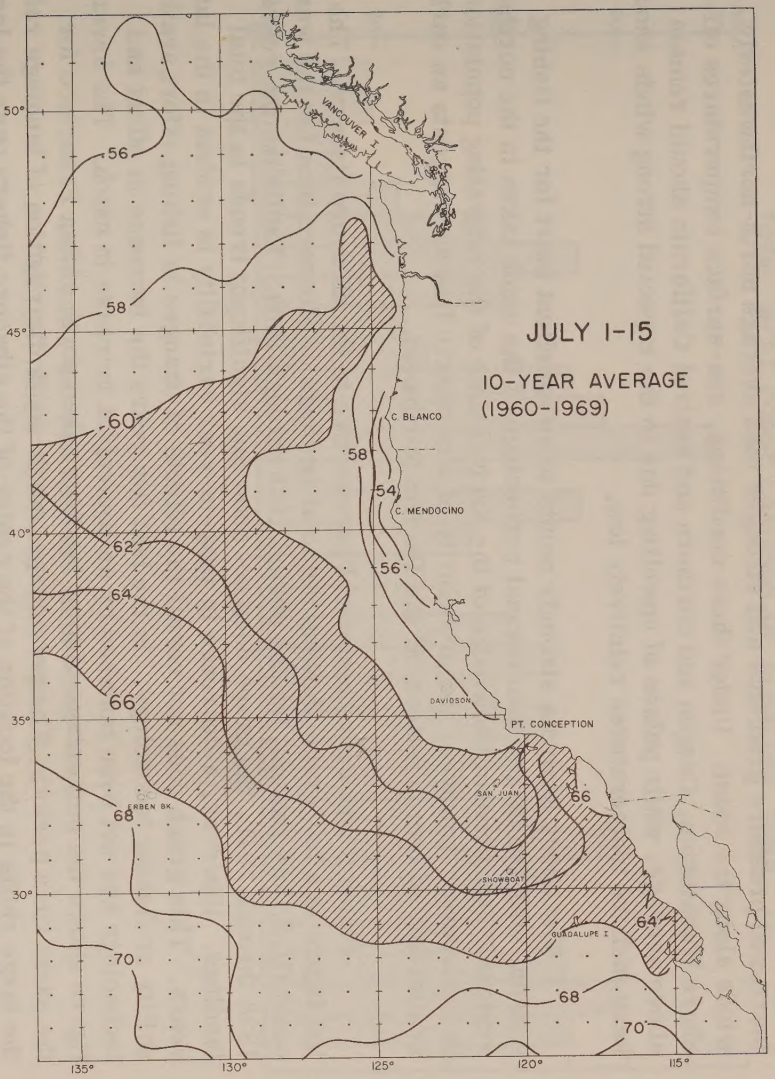


Plate 2.--Average sea surface temperature fields for the July 1-15 interval. Shaded zone delineates region where most of the albacore would be available under these conditions.

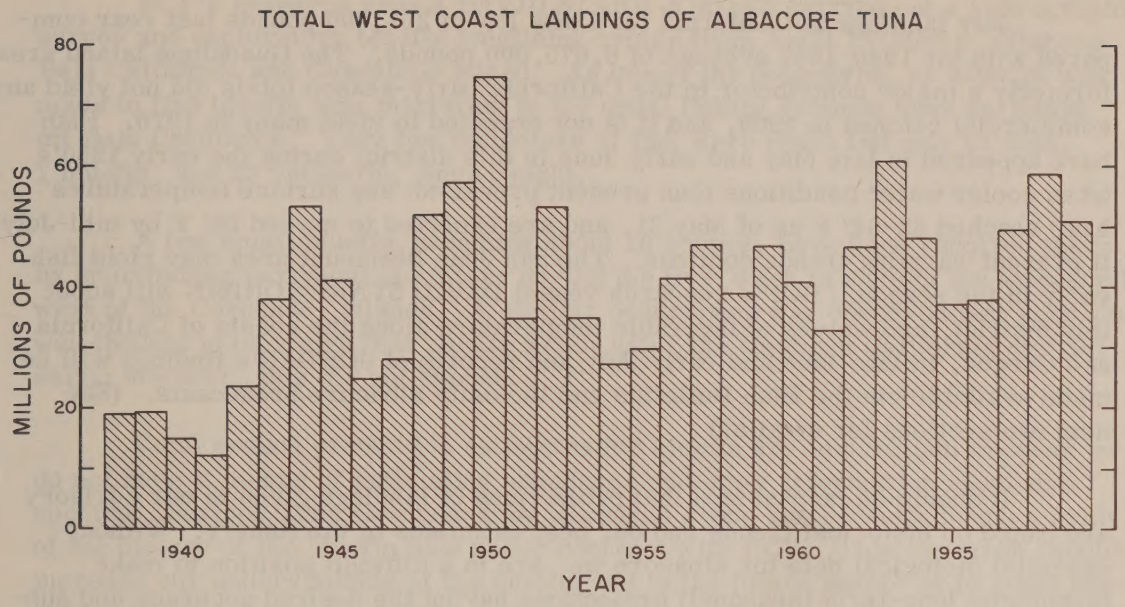
increased pressure gradients and stronger than average north-northwesterly winds along the coast. Under these conditions, sea-surface temperatures offshore Washington, Oregon and northern and central California should remain above average, while pulses of upwelling due to the expected strong winds should keep inshore temperatures relatively low.

The above analysis strongly points to an excellent start for the fishing season, with the larger than normal percentage of the catch taken in the northern regions. Our present knowledge of the arrival time of the migrating population is inadequate; however, the probability of a northerly fishery suggests an early availability of fish in waters off the Pacific Northwest.

Plates 3 and 4 give historical perspective to the albacore fishery. The top figure is a bar graph showing the total landings of albacore tuna for the west coast (U.S. and Canada) for the period 1938 through 1969. Excluding the years 1938 through 1941, the graph does not show any significant trends in the total landings. However, a decrease in year-to-year variability is evident in the later years. This graph does not reveal the effects of changes in fishing effort, availability or fishing technology. In the last few years the increase in effort and technology has not been matched by an equivalent increase in catch. The lower figure shows the percentage of total landings taken north of San Francisco for the same time period. The percentage north-south distribution of landings reflects the large shifts in the location of the center of the albacore fishery over the last two decades. An interesting and important aspect of the changes in percent distributions is that the year-to-year changes are small relative to the long-term trends. Thus, we expect again this year that a high percentage of the total catch will be north of San Francisco.

The Pacific west coast albacore landings in 1969 were 51 million pounds, which is somewhat higher than the 1960-1968 average of 46 million pounds. The statistical variance in landings for the 1960-1969 period is about 9 million pounds. Thus, according to the 1960-1969 average, an estimation of 37-55 million pounds could be landed this year.

If Oregon, Washington, and British Columbia should receive up to 75% of the total west coast landings, as they have for the past 3 years, then California will receive from 10-14 million pounds and the region to the north from 27-41 million pounds. If both regions receive 50% of the total landings, then each will receive from 18-28 million pounds. Taking into account the historical trends and our interpretation of present operational and economic implications affecting fishing effort this year, we estimate that from 11-15 million pounds may be landed in California and 26-40 million pounds could be landed in Oregon, Washington, and British Columbia.



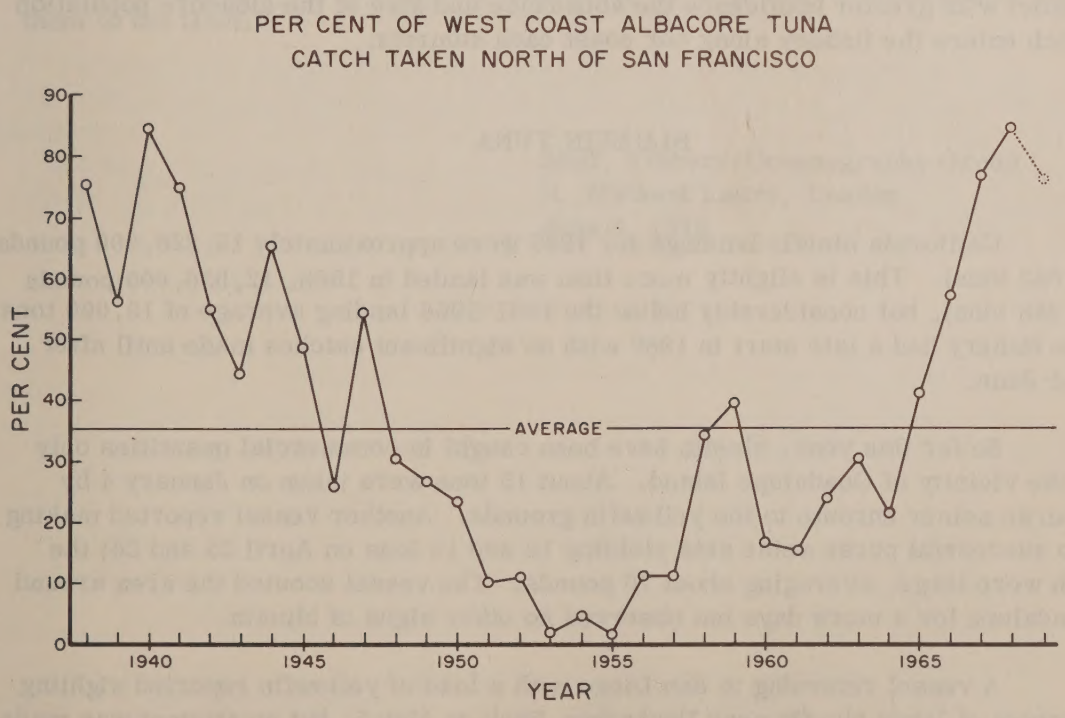


Plate 3. --Top graph: Total west coast landings of albacore tuna in millions of pounds, 1938-1969.

Plate 4. --Bottom graph: Percent of west coast albacore tuna catch taken north of San Francisco, 1938-1969.

July landings in California hit a new low of 261,000 pounds last year compared with the 1940-1967 average of 6,675,000 pounds. The Guadalupe Island area, formerly a major contributor to the California early-season totals did not yield any commercial catches in 1969, and it is not expected to yield many in 1970. Fish have appeared in late May and early June in this district during the early 1950's when cooler water conditions than present prevailed; sea surface temperatures have reached 62-64° F as of May 31, and are expected to exceed 66° F by mid-July if present warming trends continue. The San Juan Seamount area may yield fish early in the season. BCF's research vessel DAVID STARR JORDAN will scout this district, and waters of favorable temperature along the coasts of California and Oregon, in late June and early July, and reports of JORDAN's findings will be made available via the Fish Bulletins and the daily albacore broadcasts. (See next two sections for details.)

It should be emphasized that projections of landings given in our advisory are based on historical trends and our best estimates of the fishery. Without essential biological data for albacore we are in a difficult position to make meaningful long-term (seasonal) projections having the desired accuracy and substance. However, we have recently initiated a study of albacore biology on a Pacific-wide basis and we hope this will give us, in a year or so, the ability to predict with greater confidence the abundance and size of the albacore population which enters the fishery along our coast each summer.

BLUEFIN TUNA

California bluefin landings for 1969 were approximately 15,226,000 pounds (7,663 tons). This is slightly more than was landed in 1968, 12,936,000 pounds (6,468 tons), but considerably below the 1961-1966 landing average of 13,000 tons. The fishery had a late start in 1969 with no significant catches made until after mid-June.

So far this year, bluefin have been caught in commercial quantities only in the vicinity of Guadalupe Island. About 15 tons were taken on January 4 by a purse seiner enroute to the yellowfin grounds. Another vessel reported making two successful purse seine sets yielding 18 and 15 tons on April 25 and 26; the fish were large, averaging about 70 pounds. The vessel scouted the area around Guadalupe for 4 more days but observed no other signs of bluefin.

A vessel returning to San Diego with a load of yellowfin reported sighting a school of large bluefin near Uncle Sam Bank on May 5, but no attempt was made to set on the school.

BCF's research vessel DAVID STARR JORDAN carried out a hydrographic survey and exploratory bluefin longlining cruise from April 13-May 8, offshore Baja California and Guadalupe Island. As one of the objectives, an attempt was made to find bluefin tuna migrating to the usual fishing grounds near the banks off Baja California. Very few indicators of fish were found and only 24 tuna, 1 bluefin, and 23 yellowfin, were caught.

A few small bluefin, weighing about 16 pounds, have been reported taken by sportfishing partyboat operators during the first week in June in the area southwest of the Coronado Islands. A similar occurrence was observed last year and was thought to be a sign that bluefin would enter the southern California district early; however, this did not happen.

Total season production estimates for bluefin are impractical because we do not have a means of estimating abundance and other information about the species. Scripps Tuna Oceanography Research group has recently begun a study of the biology of the bluefin tuna under contract with BCF. This research should increase our understanding of the bluefin and in the future enable us to make projections of the abundance and size of the bluefin population which enters the fishery along the Baja California and southern California Coasts. In the meantime, we will monitor changing ocean and fishery conditions as closely as possible and report them to the fleet.

Staff, Fishery-Oceanography Group
R. Michael Laurs, Leader
June 8, 1970

ALBACORE SEASON—1970 OPERATIONS

A forecast of the outlook for the 1970 albacore season will be issued by the Bureau of Commercial Fisheries in early June. The forecast will include short-term projections of albacore distribution, oceanographic and atmospheric trends, and landings.

Radio Station WWD, licensed to the Bureau of Commercial Fisheries and located on the campus of the Scripps Institution of Oceanography, University of California at San Diego, will resume its broadcasts of albacore fishery information again this year. Double sideband voice broadcasts will be transmitted from WWD twice daily during weekdays only from June 17-October 31 on frequency 4415.8 kHz and 8805.6 kHz at 0600 PDT and 2045 PDT. Single sideband transmissions will be broadcast by WWD on 8805.6 and 12403.5 kHz. Broadcasts will include the latest albacore information obtained from research vessels, cooperating fishing vessels, unloading station operators, and will contain sea temperatures and other pertinent weather information believed useful to albacore fishermen.

In addition, at the end of each 15-day calendar period, the Fishery-Oceanography Center will encode and prepare for transmission (twice daily for two consecutive days the 15-day sea surface isotherm charts which are routinely mailed to about 900 readers. Map coordinates for the 15-day chart analysis ending on a given date covering the region east of 130° W. longitude and 30-50° N. latitude will be coded as part of the message.

Sample Broadcast

"Daily albacore fishery information, July 31, 1969.

Fishing information:

Strong winds in fishing district southwest 1960 fathom spot are believed to have hindered fishing there today. No fishing reports have been received from this area today. Few boats are riding the weather. Most are in port waiting for breaks in the weather.

Center of fishing off Oregon and Washington remains unchanged today in district 100-120 miles offshore Columbia River to Cape Shoalwater. One boat reported about 350 fish yesterday 90-100 miles off Cape Falcon and that some other boats had scores of 400-500 fish. Weather reported good.

Weather summary:

Large Stationary high pressure system continues to dominate weather northeastern Pacific Ocean with 1035 MB center located near 42° N., 148. W. Ridge extending from northeastern quadrant of high is building slowly over coast Washington-Oregon and northern California. Thermal trough over California interior receding southward resulting in northerly wind flow maximum offshore region from Cape Mendocino to south of Point Conception Thursday. Fairly stationary weak low pressure trough over northern Gulf of Alaska expected to remain fairly stationary through Friday. General surface pressure pattern over northeastern Pacific Ocean expected to remain fairly stationary through Friday with only regional north-south shifts in wind flow maximum off California Coast.

Conditions offshore outside 40 miles:

Oregon--Winds variable-light to moderate 8-14 knots with small seas Thursday. No change expected for Friday.

Northern California--Winds north-northwest 12-18 knots with slight to moderate seas Thursday. Little change expected for Friday.

Cape Mendocino to south of Point Conception--Strong northerly to northwesterly winds 18-30 knots with rough seas and heavy swell Thursday. Strong winds and rough seas expected to continue through Friday.

Outlook:

Expect 60-degree isotherm to build north to Destruction Island thence northwestward to 50 degrees north at 130 degrees west. Look for best fishing 50-150 miles offshore in region where depth of 60-degree isotherm is 80-100 feet. Central California offshore district should be good whenever winds and seas abate. Albacore should hold in 1960 fathom spot off Point Conception next 2 weeks as residual cold eddy persists downstream from intense upwelling zone.

Attention all boats:

Coast Guard San Francisco requests information on missing vessel COMPASS STAR-WY4440. Anyone knowing or in contact with COMPASS STARR should contact nearest Coast Guard facility.

Map coordinates of 15-day chart ending 31 July 1969 covering region east of 130° W. longitude and 25-50° N. latitude.

Message coded as follows:

First 3 numbers are latitude in degrees and tenths.
Last 4 numbers are longitude in degrees and tenths.

Message:

Position of 60 degree isotherm	Position of 64 degree isotherm
4861300	3681300
4841290	3501289
4641249	3401291
4561249	3331290
4491251	3301284
4371252	3131250
4201260	3041210
4151262	3051200
4031265	3061191
3921262	3151185
3741270	3251188
3681268	3331195
3491240	3401196
3491233	
3611222	

BCF F-O Center, La Jolla
(End of broadcast.)"

The above message, when decoded and plotted as in the example following this section, provides the fisherman at sea with a current analysis of the 60-64° F. temperature zone (from which more than two-thirds of the total Pacific coast albacore landings have been produced in recent years). In addition, a summary of the Fishery-Oceanography Center staff's best estimate of what is expected to happen in the succeeding 15-day period will be included as in the sample above.

To make the advisory broadcast fully effective, the Fishery-Oceanography Center requires timely information from all sources at sea and ashore. To provide a medium for communication of oceanographic and current fishing data, Radio Station WWD will operate on the following frequencies and scheduled times:

Voice only	Telegraph only
4,415.8 kHz	4,262 kHz
8,805.6 kHz	8,698 kHz
12,403.5 kHz	12,871 kHz
16,533.5 kHz	17,105 kHz
22,079.5 kHz	22,419 kHz

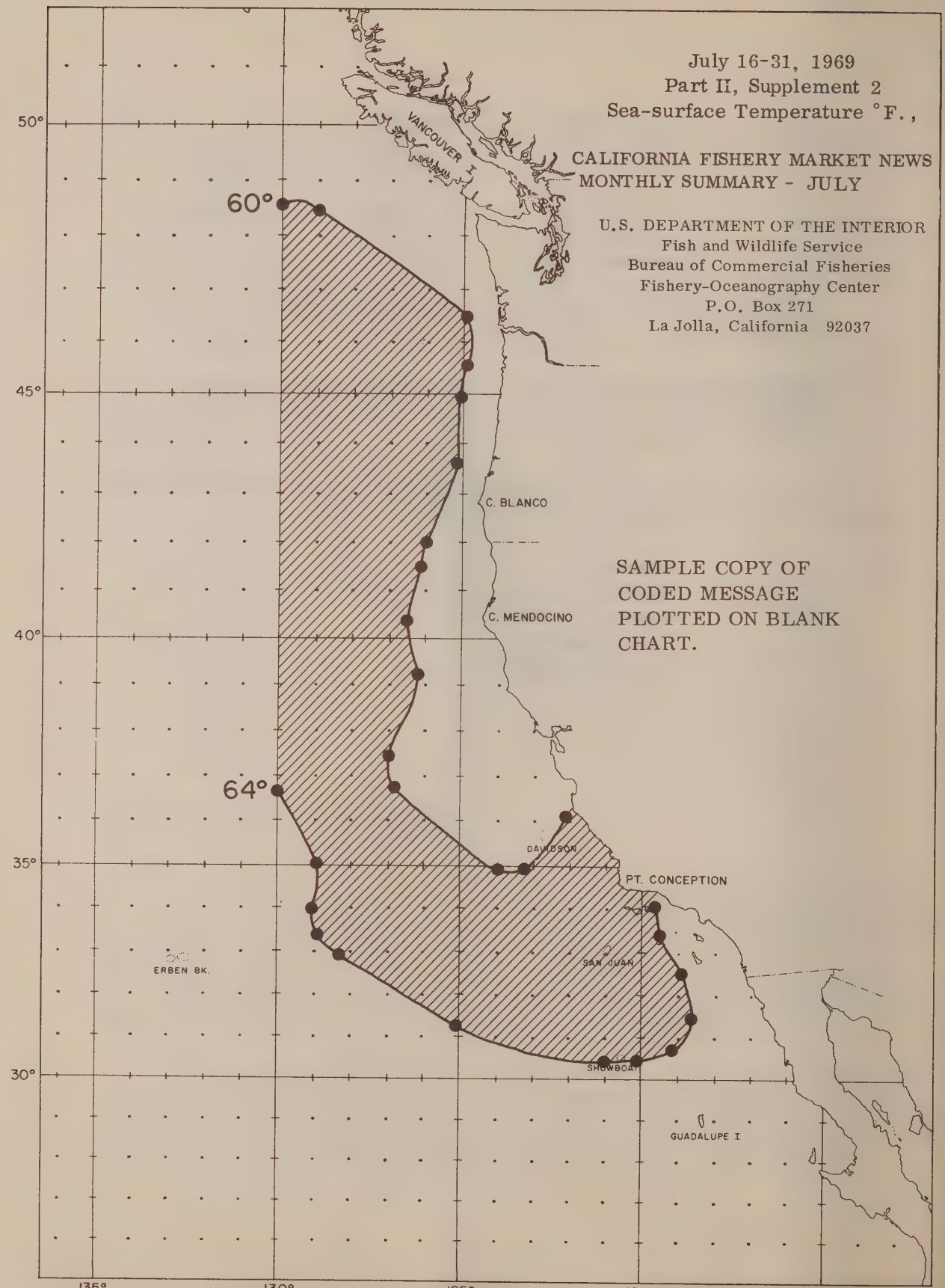
Hours of Operation: Unlimited as requested, normally 0400-0100 local time 7 days per week, including holidays.

Class of Traffic: As approved by Radio Station WWD. Inter-ship operation, other than for relay of traffic and scientific exchange of data, is not authorized.

Boat operators interested in participating to provide information services directly to WWD are requested to write for further details to:

Director
Bureau of Commercial Fisheries
Fishery-Oceanography Center
P. O. Box 271
La Jolla, California 90237

Staff, Fishery-Oceanography Program
May 6, 1970


July 16-31, 1969
Part II, Supplement 2
Sea-surface Temperature °F.,
CALIFORNIA FISHERY MARKET NEWS
MONTHLY SUMMARY - JULY
U.S. DEPARTMENT OF THE INTERIOR
Fish and Wildlife Service
Bureau of Commercial Fisheries
Fishery-Oceanography Center
P.O. Box 271
La Jolla, California 92037
SAMPLE COPY OF
CODED MESSAGE
PLOTTED ON BLANK
CHART.
50°
45°
40°
35°
30°
60°
64°
VANCOUVER I
C. BLANCO
C. MENDOCINO
DAVIDSON
PT. CONCEPTION
ERBEN BK.
SAN JUAN
SHOWBOAT
GUADALUPE I

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF COMMERCIAL FISHERIES
Fishery-Oceanography Center
La Jolla, California 92037

and

DEPARTMENT OF OCEANOGRAPHY
OREGON STATE UNIVERSITY
CORVALLIS, OREGON 97331

TO: All Albacore Fishermen, Buyers, Processors and Other Interested Parties

Advisory information to the albacore fishing industry this season promises to be the best on record. Advisory information will include a forecast of the outlook for the 1970 season, daily broadcasts of albacore information over marine radio bands, temperature charts, fish bulletins, and early and late season scouting and survey cruises. This will all come about because of cooperation among federal and state agencies and industry including the Bureau of Commercial Fisheries Fishery-Oceanography Center at La Jolla, California (BCF), Oregon State University (OSU), Navy Fleet Numerical Weather Central at Monterey, California (FNWC), Fish Commission of Oregon, California Department of Fish and Game, Washington Department of Fisheries, U.S. Weather Bureau, Pacific Northwest Bell Telephone Company, U.S. Coast Guard, U.S. Air Force, National Aeronautics and Space Administration, and cooperating albacore fishermen, buyers, and processors.

A forecast of the outlook for the 1970 albacore season will be issued by BCF in early June. The forecast will include short-term projections of albacore distribution, oceanographic and atmospheric trends, and landings. Much of the environmental information used by BCF in albacore forecasting operations is made available through a cooperative arrangement with the Navy FNWC at Monterey, California.

BCF and OSU Albacore Central will cooperate closely on issuance of a daily broadcast over radio station WWD, which is licensed to BCF and located on the campus of Scripps Institution of Oceanography at La Jolla, California, and the Astoria Marine Operator (KFX, 2598 kHz). Broadcasts will include latest albacore information obtained from research vessels, cooperating fishing vessels, unloading station operators, and will contain sea surface temperatures and other pertinent oceanographic information and weather information which may be useful to albacore fishermen. Double sideband voice broadcasts will be broadcast by WWD twice daily during weekdays only from June 22-October 31, or until the season ends, on frequency 4415.8 kHz and 8805.6 kHz at 0600 PDT and 1945 PDT. Single sideband transmissions will be broadcast by WWD on 8805.6, and 12403.5 kHz. The same broadcast, with marine weather information for California deleted and tailored for the Pacific Northwest, will be broadcast by the Astoria Marine Operator KFX at 1015 PDT and 2215 PDT on 2598 kHz. The Astoria Marine Operator will also broadcast an albacore advisory message on weekends at the same hours. The heading for the WWD broadcast will be "Daily Albacore Fishery Information (date)" and for the Astoria Marine Operator, will be "Daily Albacore Fishery Information compiled by Bureau of Commercial Fisheries and Oregon State University."

As has been done for the past 10 years, BCF will issue 15-day sea surface temperature charts from April 15 to October 31 or until the season ends, for the area roughly between central Baja California and Vancouver Island out to 135° W. A fish bulletin will also be issued with each temperature chart beginning about June 15 to the end of the season. These bulletins will include: information on oceanographic and atmospheric trends, locations of productive fishing areas, changes in market and unloading conditions which may affect effort, and other data as are appropriate. In addition BCF will publish a 30-day chart showing barometric pressure and wind direction and speed for the previous 30-days and a chart showing the 10-year average barometric pressure and winds for that month. In addition, OSU Albacore Central will again issue fish bulletins and sea surface temperature charts this year. These charts will concentrate on small-scale features along the Oregon coast out to 200 nautical miles as information becomes available, but will probably not be issued so frequently as last summer's once per week. The BCF and OSU temperature charts and fish bulletins will be bulk-mailed to fish buying stations and others for further hand-distribution to fishermen. BCF and OSU Albacore Central have exchanged bulk-mailing lists in an effort to extend advisory information to more fishermen.

This season California and Oregon waters will be the best-scouted for albacore in recent years. BCF's research vessel DAVID STARR JORDAN will sail on June 22 from San Diego southwesterly to about 150 miles offshore, then northwesterly to the vicinity of San Juan Seamount and then proceed north up the coasts of California and Oregon in waters of favorable temperature, probably about 150 miles offshore. This track is flexible and will be altered if deemed necessary in light of conditions found to be prevailing in early June. The cruise will end on July 3 in Newport, Oregon, from where JORDAN will sail for other studies. Trolling for albacore during daylight hours will be carried out along the entire track of the scouting cruise, with each day's fishing beginning where it was stopped the prior day. The thermo-salinograph will be operated continuously and information on mixed layer depth will be obtained from XBT drops. Other oceanographic observations will be made at night including midwater trawl and zooplankton hauls which will be used to obtain estimates of potential albacore forage; subsurface salinity and temperature observations will also be made. JORDAN will also make a cruise in October to study where the albacore exit the Pacific coast fishery and what environmental conditions accompany the decay of the albacore season. The Fish Commission of Oregon plans a 10-day charter cruise to scout for albacore in waters of favorable temperature off the coast of Oregon commencing about July 1 aboard F/V SUNRISE. In addition, Oregon State University research vessels YAQUINA and CAYUSE will occupy hydrographic survey lines off Oregon out to about 200 miles offshore between June 19 and July 3, and will troll for albacore during daylight hours when in favorable water temperatures. Oregon State University also plans additional albacore oceanography cruises on R/V CAYUSE off Oregon as follows: July 27-August 2, August 7-12, August 25-September 1, and September 8-14. In addition, in similar fashion to last summer, OSU will coordinate a series of remote-sensing overflights by Coast Guard, Air Force, and NASA aircraft off Oregon and Washington. These flights will examine sea-surface temperature and water color patterns; information collected from the flights will be included in the daily messages and periodic bulletins. All fish reports from the scouting

vessels, negative as well as positive, will be incorporated into daily albacore advisory broadcasts over WWD and the Astoria Marine Operator. The JORDAN will also transmit her fishing reports to interested boats over the normal fishing boat frequencies. The call letters for JORDAN are WTDK.

The success of the cooperative albacore advisory program depends on the input of timely, first-hand information from fishermen at sea, as well as from dock operators and processors. It cannot be overstated how insufficient information restricts the quality and timeliness of the advisory materials. To provide a medium for communication of oceanographic and current fishing data, radio station WWD will operate as follows:

Frequencies:

Voice only	Telegraph only
4,415.8 kHz	4,262 kHz
8,805.6 kHz	8,698 kHz
12,403.5 kHz	12,871 kHz
16,533.5 kHz	17,105 kHz
22,079.5 kHz	22,419 kHz

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Class of Traffic: As approved by radio station WWD. Inter-ship operation, other than for relay of traffic and scientific exchange of data, is not authorized.

Boat operators interested in participating to provide information services directly to WWD and BCF are requested to write for further details to:

Director
Bureau of Commercial Fisheries
Fishery-Oceanography Center
P.O. Box 271
La Jolla, California 92037

OSU Albacore Central may be contacted by writing:

Albacore Central
Department of Oceanography
Oregon State University
Corvallis, Oregon 97331

or by calling collect (503) 754-3354.

In addition to attempting to provide service of value to the fishing industry, there are also strong concurrent research programs which seek to learn more about the distribution, abundance and availability of albacore tuna in the northeast Pacific Ocean. Satisfactory measurement of the biological aspects of the albacore tuna population and the effects of varying economic conditions have lagged far behind progress in monitoring and understanding the environment. Little progress has been made on the estimation of year-class strength, apparent fish abundance, and fishing effort for albacore. Much of this information must come from you, the fishermen, by keeping logbook records. If any fisherman does not have a logbook and is willing to keep one, please contact OSU Albacore Central or California Department of Fish and Game, Terminal Island, California.

Good fishing! And please let us know if we can assist you in any other way.

R. Michael Laurs
Leader, Fishery-Oceanography Group
Fishery-Oceanography Center
Bureau of Commercial Fisheries

Daniel Panshin
Oceanographer, Sea Grant
Albacore Central
Oregon State University

SEA SURFACE TEMPERATURE CHARTS, EASTERN PACIFIC OCEAN
MAY 1970

Acknowledgements

The following organizations and stations contributed data for the May 1970 charts:

U.S. Bureau of Commercial Fisheries Biological Laboratories La Jolla, California, Honolulu, Hawaii, and Seattle, Washington
U.S. Coast Guard Cutter ACUSHNET
U.S. Naval Weather Service, Fleet Numerical Weather Central, Monterey, California
Chevron Shipping Company; S.S. IDAHO STANDARD
Environmental Science Services Administration
U.S. Weather Bureau, San Diego, California
U.S. Coast and Geodetic Survey, Pacific Marine Center, Seattle, Washington
General Dynamics Convair Division; Ocean Data Buoy ALPHA
Global Marine Inc.; GLOMAR CHALLENGER
Hopkins Marine Station, Pacific Grove, California, J.P. Balesteri
Inter-American Geodetic Survey by L. Peren at Puerto Armuelles, Panama; D. Chavez at Talara, Peru; G. Castillo at San Juan, Peru
Kelco Company, San Diego, California
LMR Inc., San Diego, California
Matson Navigation Company, San Francisco; S.S. CALIFORNIAN
Oregon State University, Department of Oceanography, Corvallis, Oregon, R/V YAQUINA
Pacific Missile Range, Range Operations Department, Geophysics Division, Point Mugu, California
Pacific Oceanographic Group, Nanaimo, British Columbia, by H. J. Hollister from observations by G. C. Wilks at Langara Island Light; R. W. Pigott at Cape St. James Light; Lily Collins at Kains Island Lightstation; O. A. Edwards at Amphitrite Point Light
Scripps Institution of Oceanography, La Jolla, California, by Margaret Robinson
Scripps Institution of Oceanography Research Vessels ALEXANDER AGASSIZ, THOMAS WASHINGTON, ELLEN B. SCRIPPS, OCONOSTOTA, FLIP, ALPHA HELIX
Texas A & M University, R/V ALAMINOS
Fishing Vessels MARTINAC, BONNIE JEAN

Charts

Figure 1. --Mean sea surface temperature (°F). Squares show temperatures at weather ship stations. Numerals on shore are temperatures at coastal and lightship stations.

Figure 2. --Deviation of sea surface temperatures (°F) from long term charts of H. O. 225. Hatched areas are colder in 1970.

Figure 3. --Deviation of sea surface temperatures (°F) from those of May 1969. Hatched areas are colder in 1970.

Figure 4. --Mean sea surface temperature (°F). Numerals on shore are temperatures at coastal stations.

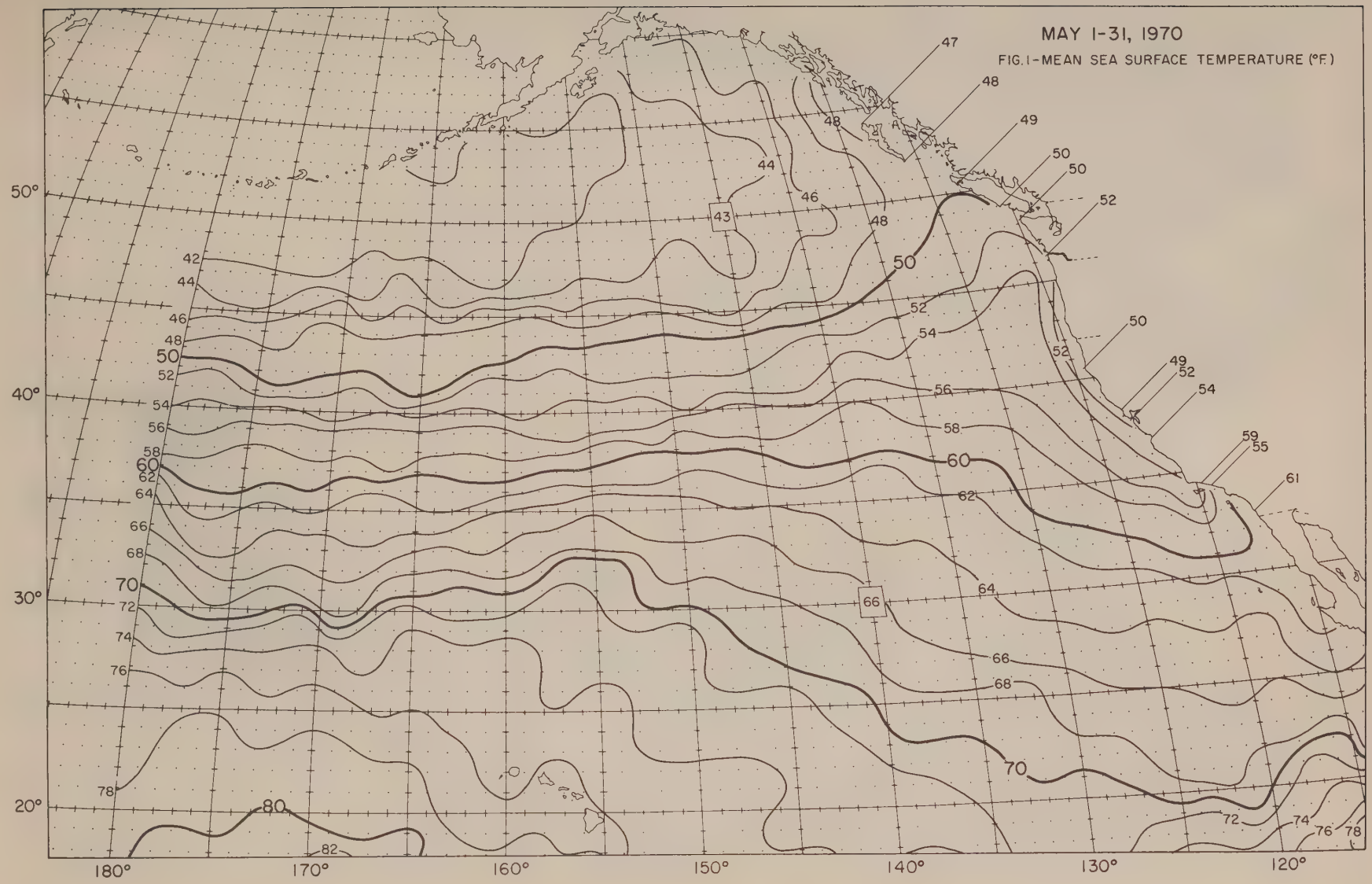
Figure 5. --Deviation of sea surface temperatures (°F) from long term charts of H. O. 225 and NAVOCEANO Sp-123. Shaded areas are colder in 1970.

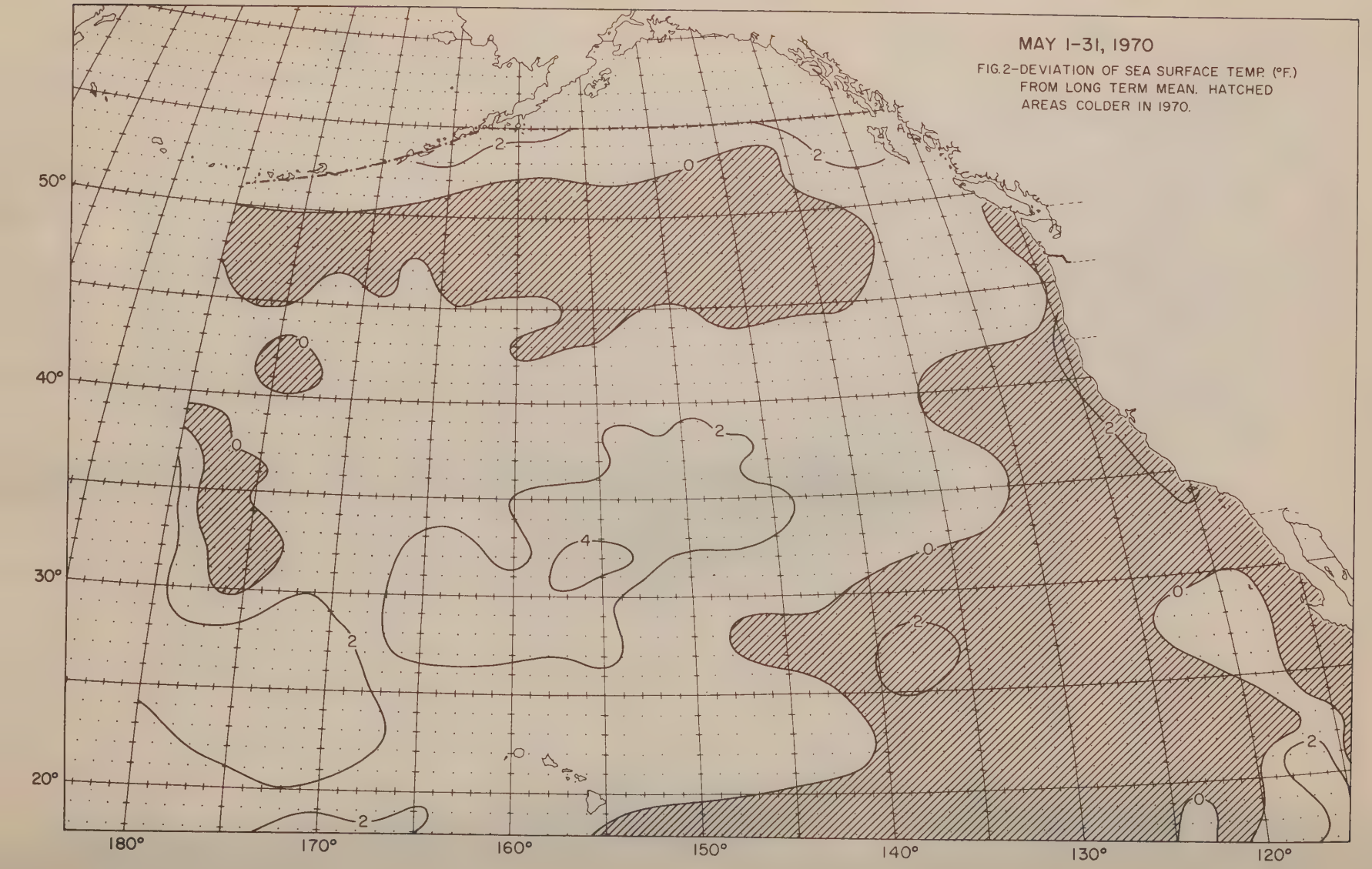
Figure 6. --Deviation of sea surface temperatures (°F) from those of May 1969. Shaded areas are colder in 1970.

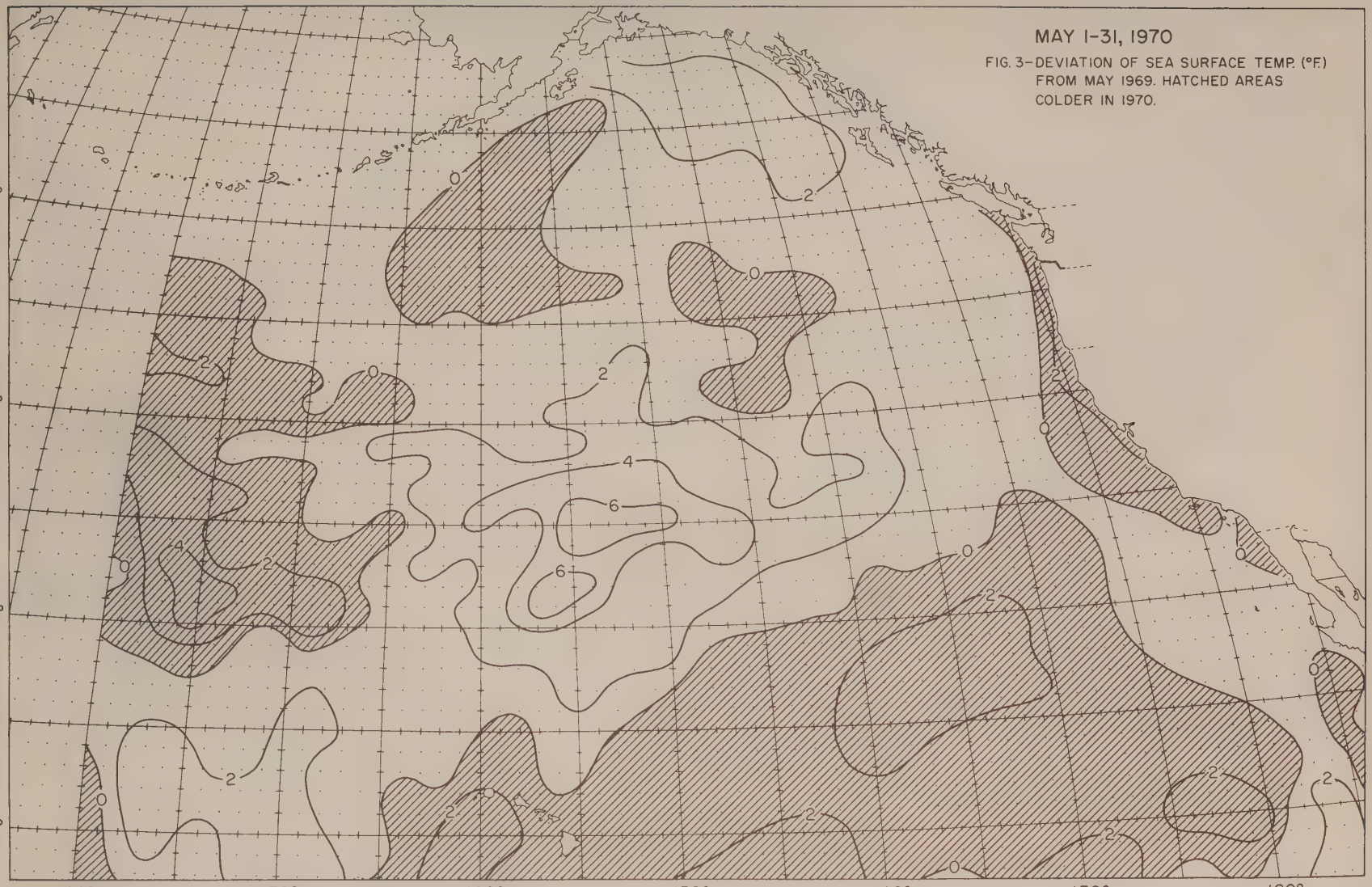
Figure 7. --10-year mean (1961-1970) observed sea level values of barometric pressure (millibars), resultant wind direction (degrees true), resultant wind speed (knots), and average wind speed (knots) regardless of direction.

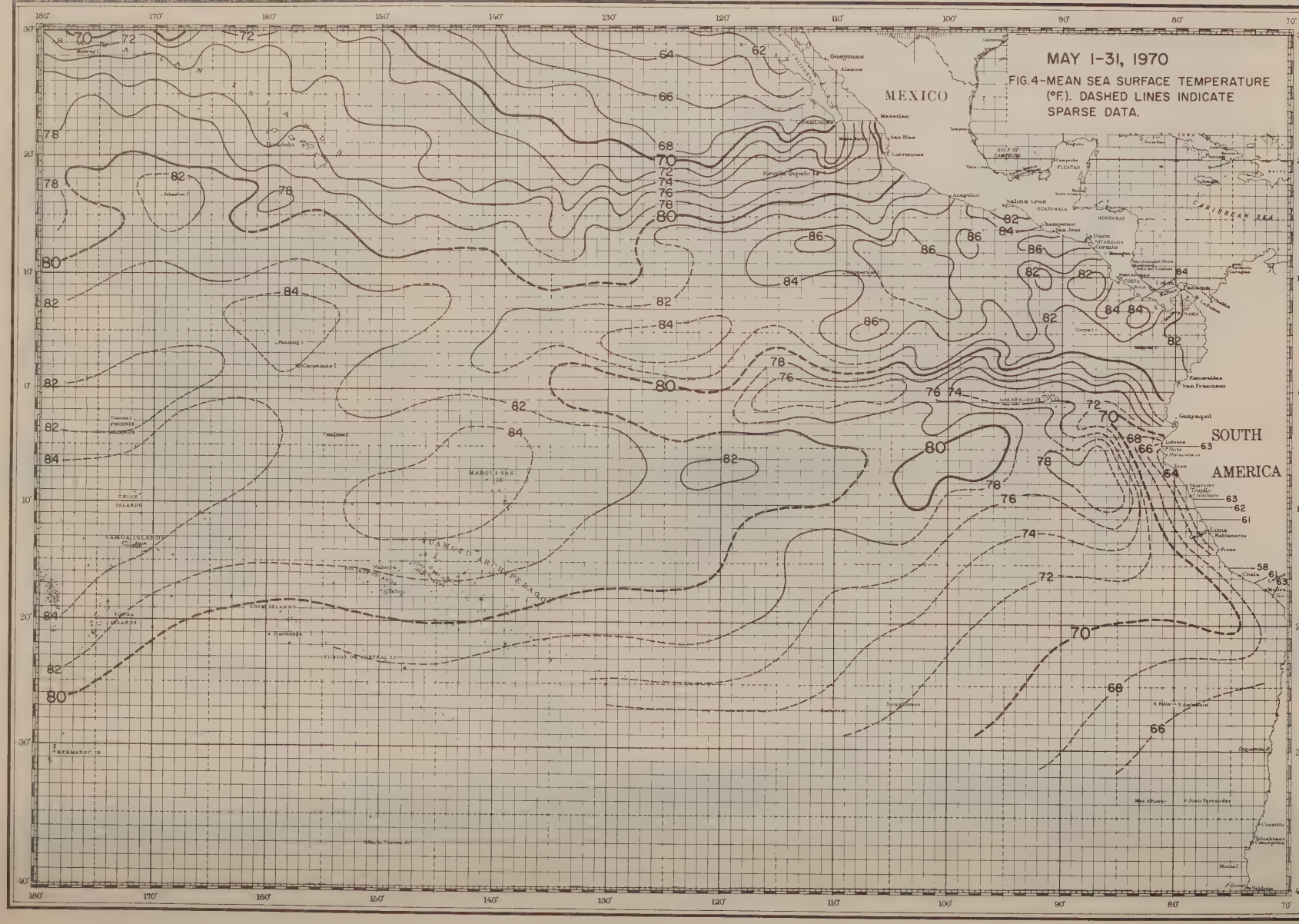
Figure 8. --Observed sea level values of barometric pressure (millibars), resultant wind direction (degrees true), resultant wind speed (knots), and average wind speed (knots) regardless of direction.

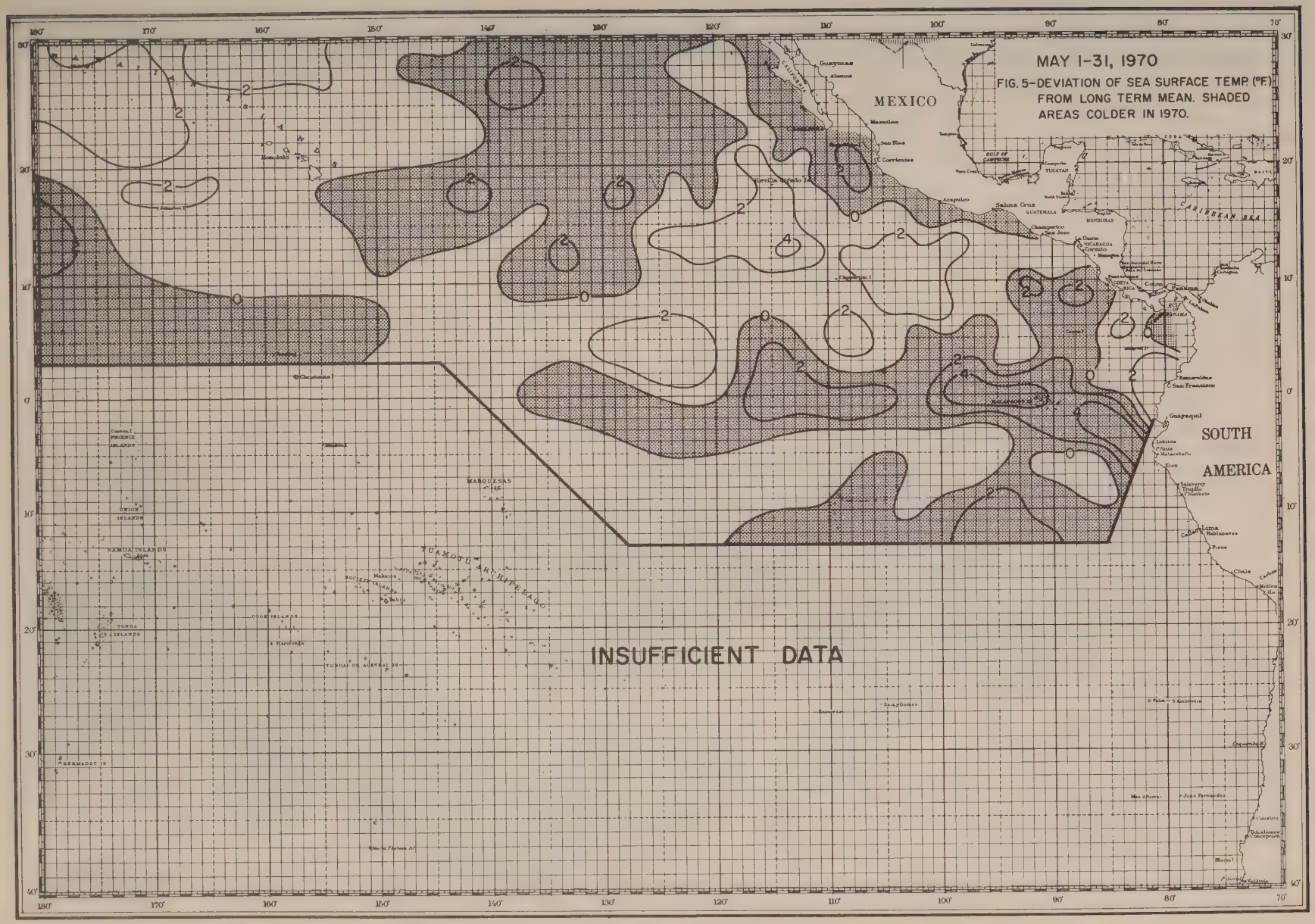
James A. Renner, Fishery Biologist
Kenneth S. Raymond, Scientific Illustrator
June 8, 1970

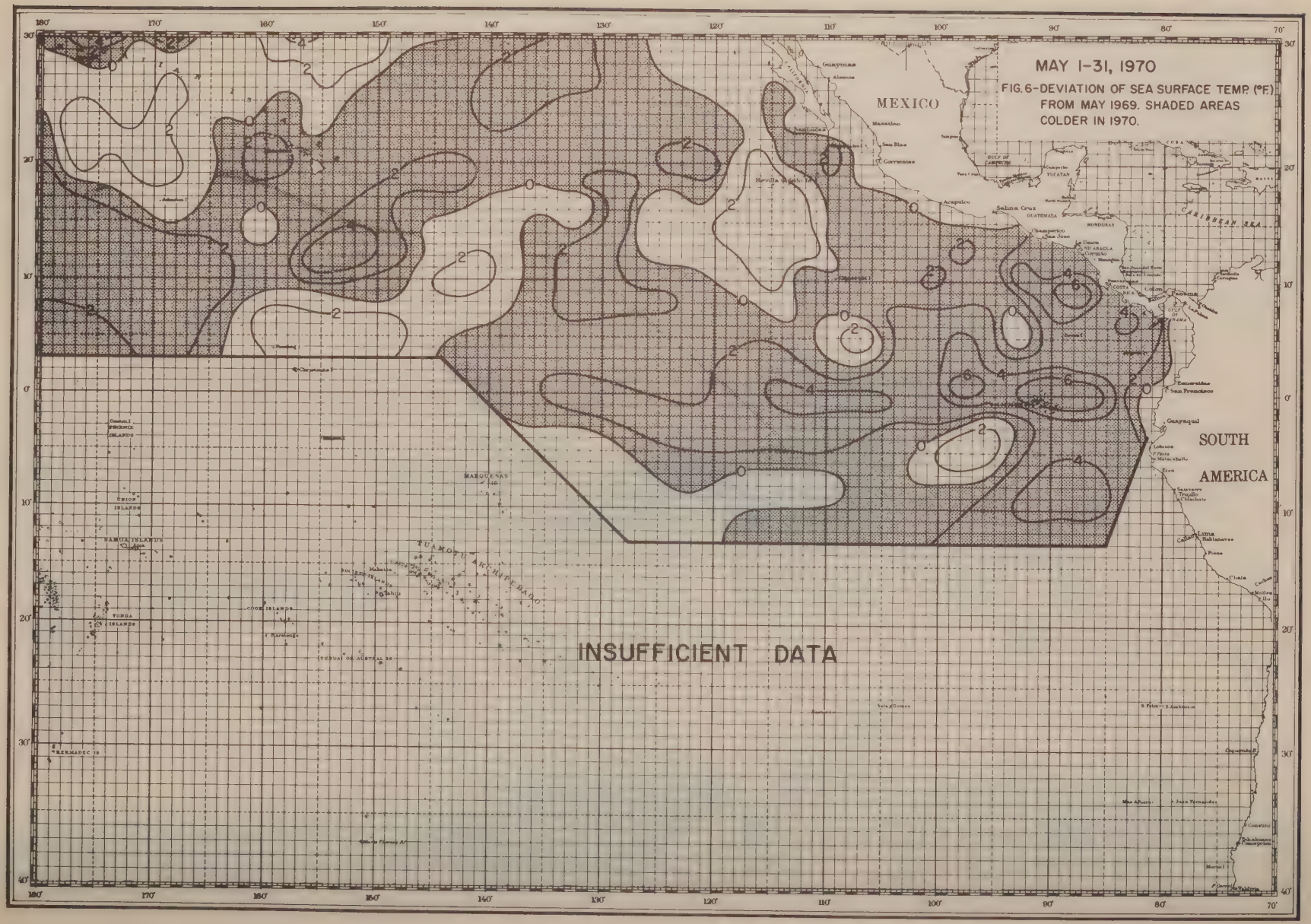

MAY 1-31, 1970
FIG. 1-MEAN SEA SURFACE TEMPERATURE (°F.)
50°
40°
30°
20°
180°
170°
160°
150°
140°
130°
120°
43
66

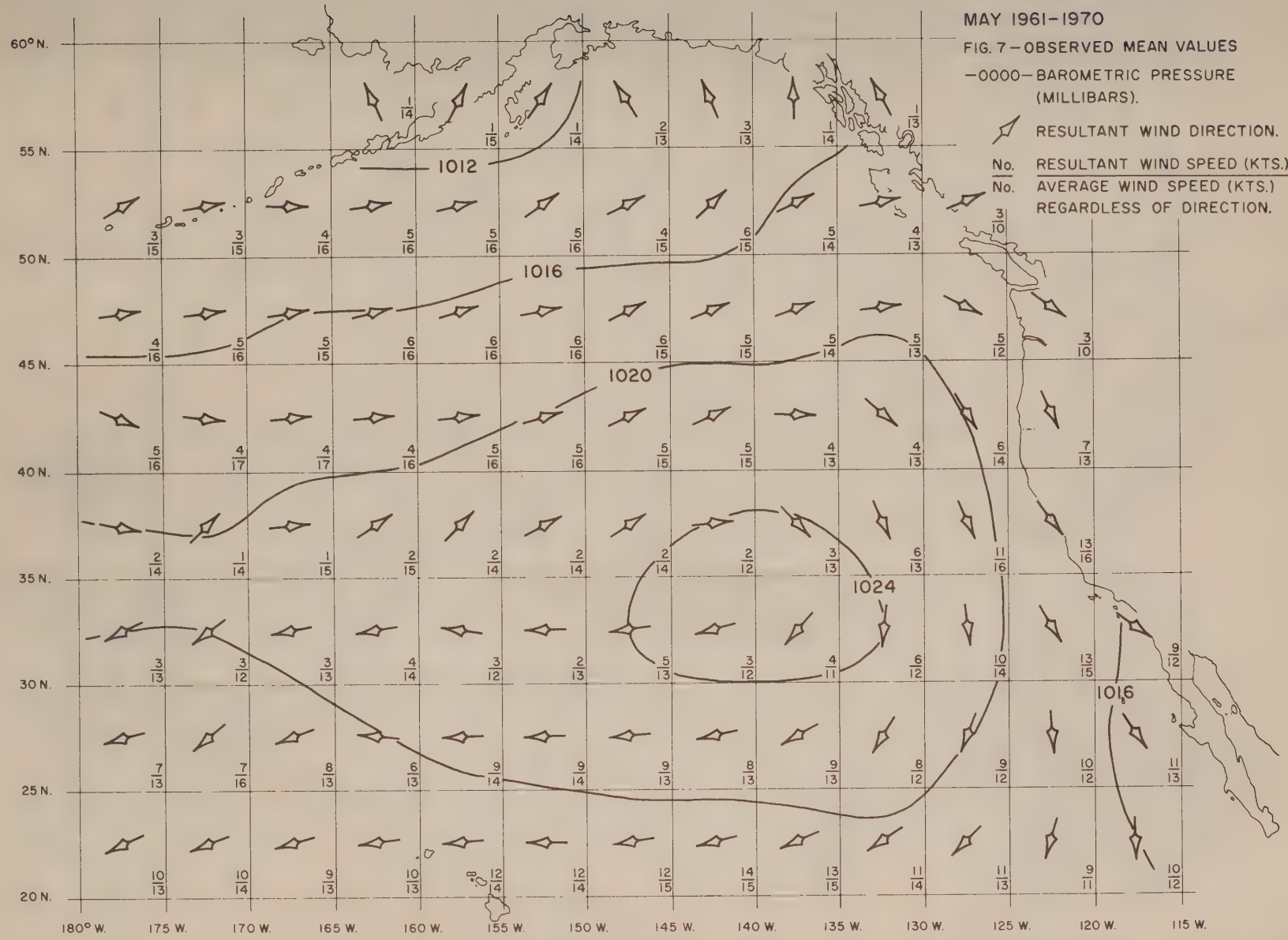

MAY 1-31, 1970
FIG. 2-DEVIATION OF SEA SURFACE TEMP. (°F.) FROM LONG TERM MEAN. HATCHED AREAS COLDER IN 1970.
50°
40°
30°
20°
180°
170°
160°
150°
140°
130°
120°
2
0
2
0
2
4
0
2
0
0
2
2
0

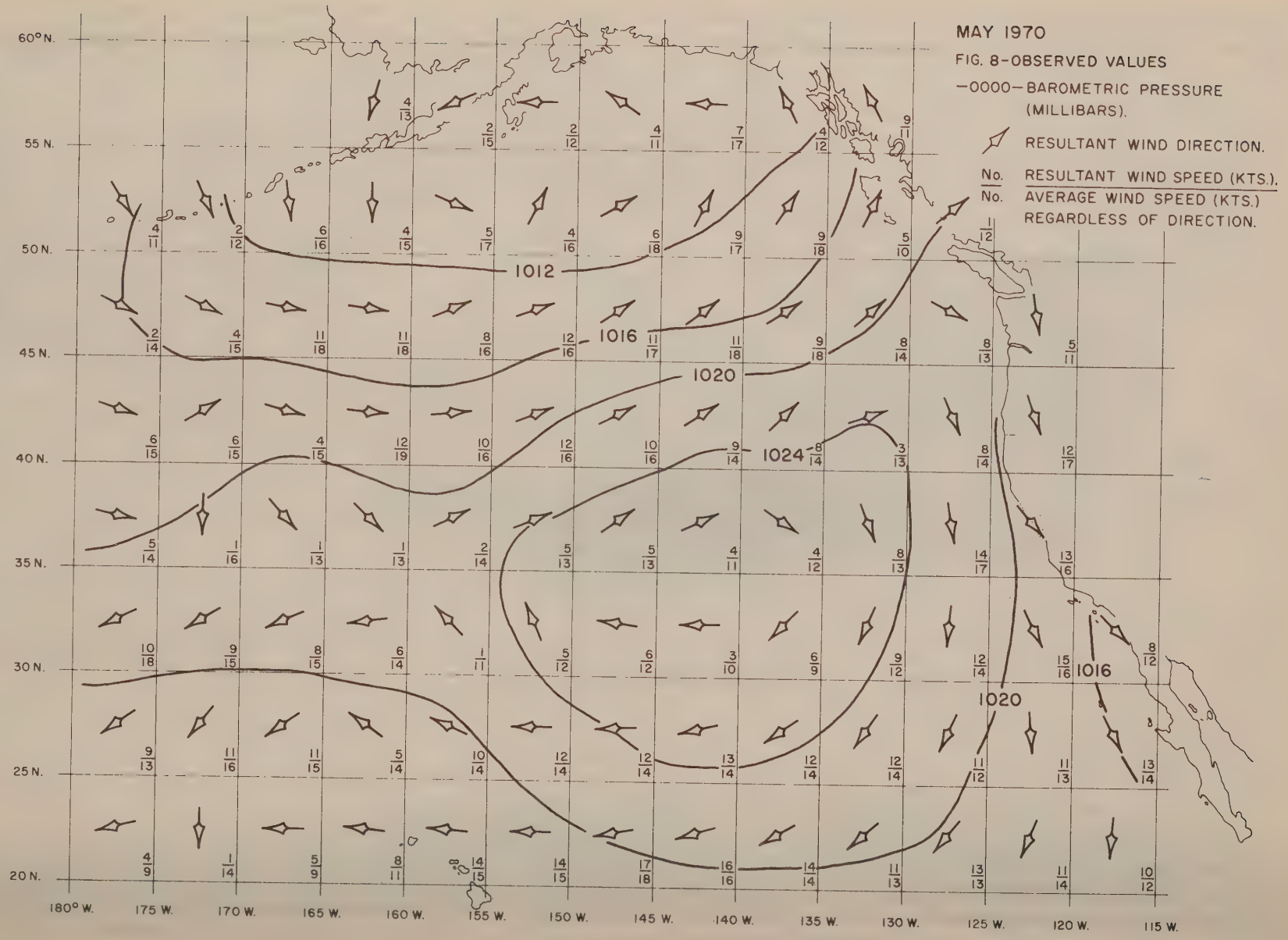

MAY 1-31, 1970
FIG. 3-DEVIATION OF SEA SURFACE TEMP. (°F) FROM MAY 1969. HATCHED AREAS COLDER IN 1970.
50°
40°
30°
20°
180°
170°
160°
150°
140°
130°
120°
0
2
4
6

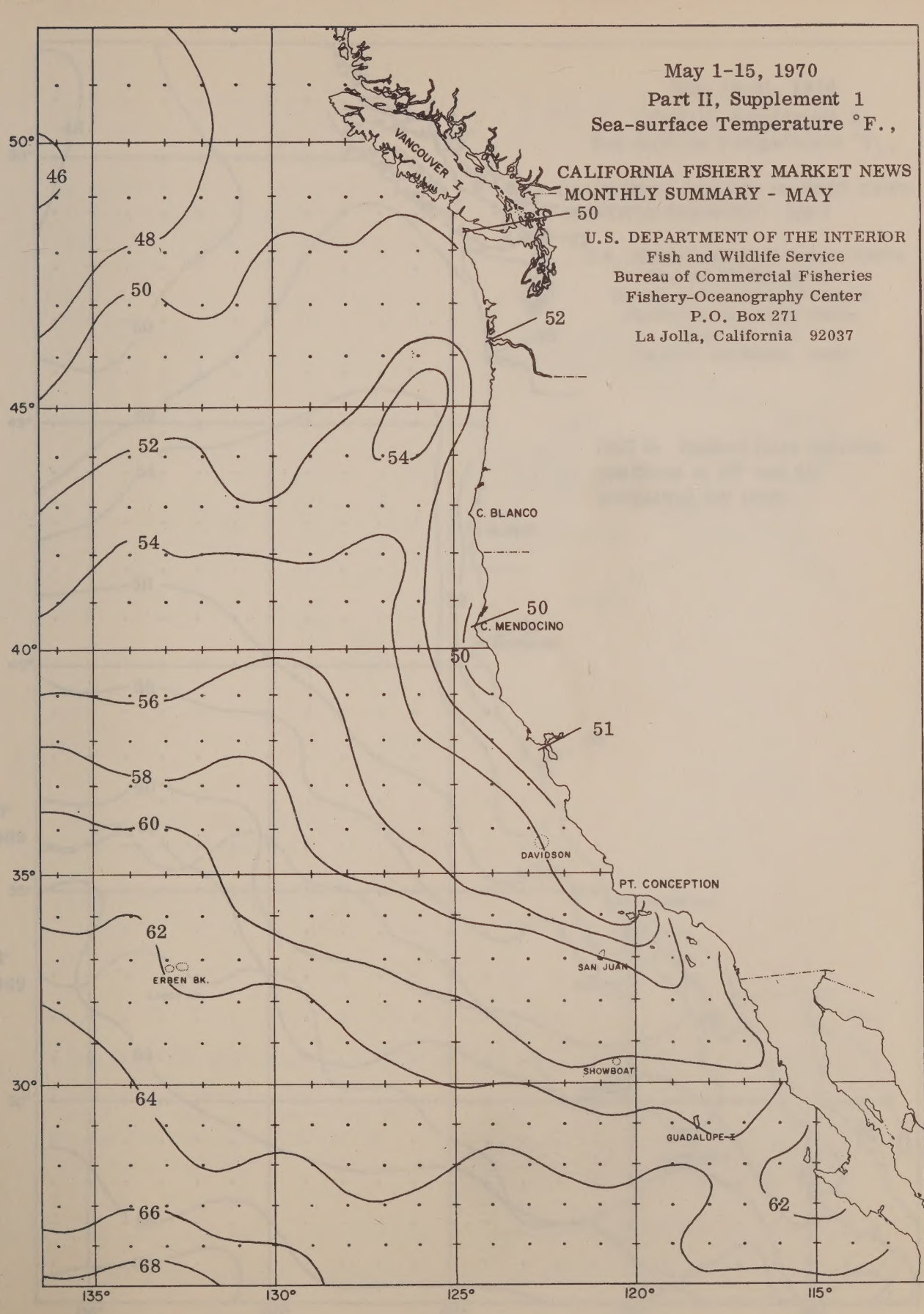

MAY 1-31, 1970
FIG. 4-MEAN SEA SURFACE TEMPERATURE (°F). DASHED LINES INDICATE SPARSE DATA.
MEXICO
SOUTH AMERICA
CARIBBEAN SEA
GUATEMALA
HONDURAS
COSTA RICA
PANAMA
GULF OF CAMPECHE
YUCATAN
CUBA
GALAPAGOS IS.
MARQUESAS IS.
SAMOA ISLANDS
TUAMOTU ARCHIPELAGO
TONGA ISLANDS
COOK ISLANDS
PHOENIX ISLANDS
LINE ISLANDS
Acapulco
Salina Cruz
Guayaquil
Panama
Callao
Lima
Arica
Iquique
Antofagasta
Valparaiso
Easter I.
Juan Fernandez
Mas Afuera
Mas Tierra
Pitcairn I.
Tahiti
Raratonga
Samoa
Fanning I.
Christmas I.
Johnston I.
Palmyra I.
Jarvis I.
Canton I.
Enderbury I.
Nukufetau
Funafuti
Nanumea
Nukunonu
Fakaofo
Atafu
Manihiki
Rakahanga
Penrhyn
Nassau I.
Suwarrow I.
Aitutaki
Manuae
Mauke
Mitiaro
Atiu
Rarotonga
Mangaia
Tubuai
Rapa
Rurutu
Raivavae
Tupuai
Rimatara
Rurutu
Tahuata
Hiva Oa
Fatu Hiva
Nuku Hiva
Ua Huka
Ua Pou
Eiao
Hatutu
Motane
Fatu Hiva
Pukapuka
Nassau
Suwarrow
Bellingshausen I.
Sala y Gomez I.
Desventuradas Is.
Guadalupe I.
Revilla Gigedo Is.
Clipperton I.
Cocos I.
Malpelo I.
Galapagos Is.
Tres Marias Is.
Islas Marias
Socorro I.
Roca Partida
Isla Tres Marias
Isla Isabel
Isla Socorro
Isla Clarion
Isla

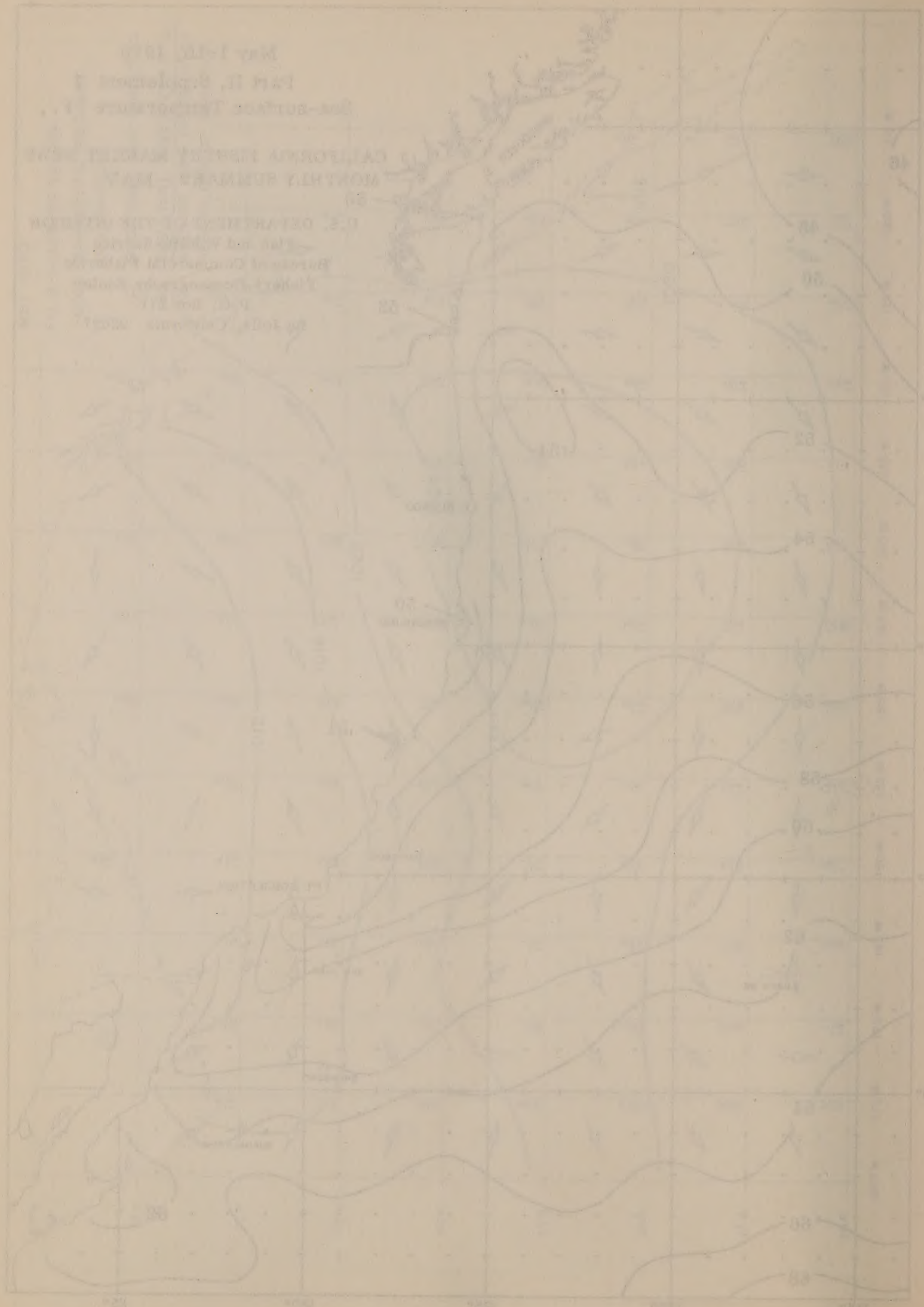

MAY 1-31, 1970
FIG. 5-DEVIATION OF SEA SURFACE TEMP. (°F.) FROM LONG TERM MEAN. SHADED AREAS COLDER IN 1970.
INSUFFICIENT DATA
MEXICO
SOUTH AMERICA
CARIBBEAN SEA
MARQUESAS
TUAMOTU ARCHIPELAGO
HAWAIIAN ISLANDS
COOK ISLANDS
SAMOA ISLANDS
PHOENIX ISLANDS
UNION ISLANDS
TONGA ISLANDS
BERMUDEZ IS.
Honolulu
Acapulco
Salina Cruz
Guaymas
Mazatlan
San Blas
Corrientes
Manzanillo
Champerico
Puerto Caldera
Callao
Lima
Guayaquil
Chile
Peru
Ecuador
Panama
Costa Rica
Guatemala
Honduras
Nicaragua
Cuba
Yucatan
Gulf of Panama
Gulf of Campeche
Gulf of California
Galapagos Is.
Juan Fernandez
Easter I.
Pitcairn I.
Tahiti
Samoa
Fiji
Tonga
Cook Islands
Marquesas
Tuamotu Archipelago
Hawaiian Islands
Phoenix Islands
Union Islands
Samoa Islands
Bermudez Is.

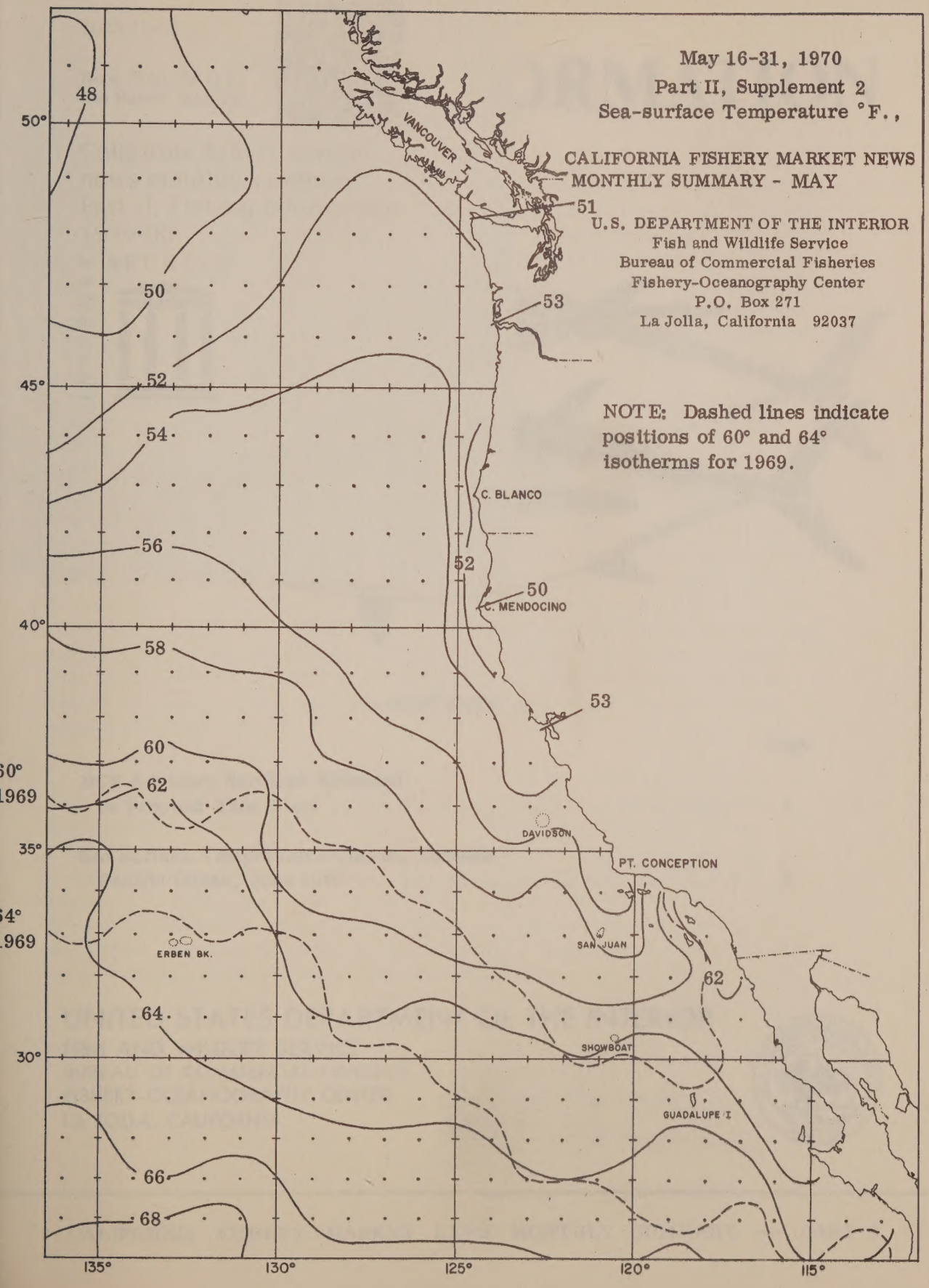

MAY 1-31, 1970
FIG. 6-DEVIATION OF SEA SURFACE TEMP (°F) FROM MAY 1969. SHADED AREAS COLDER IN 1970.
INSUFFICIENT DATA
MEXICO
SOUTH AMERICA
CARIBBEAN SEA
GUATEMALA
HONDURAS
COSTA RICA
PANAMA
GUAYAQUIL
LIMA
MARQUESAS
TUAMOTU ARCHIPELAGO
SAMOA ISLANDS
TONGA ISLANDS
COOK ISLANDS
UNION ISLANDS
FRENCH ISLANDS
BERMADEC IS
180°
170°
160°
150°
140°
130°
120°
110°
100°
90°
80°
70°
30°
20°
10°
0°
10°
20°
30°
40°


MAY 1961-1970
FIG. 7 - OBSERVED MEAN VALUES
-0000- BAROMETRIC PRESSURE (MILLIBARS).
RESULTANT WIND DIRECTION.
No. RESULTANT WIND SPEED (KTS.).
No. AVERAGE WIND SPEED (KTS.) REGARDLESS OF DIRECTION.
1012
1016
1020
1024
1016
60° N.
55 N.
50 N.
45 N.
40 N.
35 N.
30 N.
25 N.
20 N.
180° W.
175 W.
170 W.
165 W.
160 W.
155 W.
150 W.
145 W.
140 W.
135 W.
130 W.
125 W.
120 W.
115 W.


MAY 1970
FIG. 8-OBSERVED VALUES
—0000— BAROMETRIC PRESSURE (MILLIBARS).
RESULTANT WIND DIRECTION.
No. RESULTANT WIND SPEED (KTS.).
No. AVERAGE WIND SPEED (KTS.) REGARDLESS OF DIRECTION.
1012
1016
1020
1024
1016
1020
60° N.
55 N.
50 N.
45 N.
40 N.
35 N.
30 N.
25 N.
20 N.
180° W.
175 W.
170 W.
165 W.
160 W.
155 W.
150 W.
145 W.
140 W.
135 W.
130 W.
125 W.
120 W.
115 W.


May 1-15, 1970
Part II, Supplement 1
Sea-surface Temperature °F.,
CALIFORNIA FISHERY MARKET NEWS
MONTHLY SUMMARY - MAY
U.S. DEPARTMENT OF THE INTERIOR
Fish and Wildlife Service
Bureau of Commercial Fisheries
Fishery-Oceanography Center
P.O. Box 271
La Jolla, California 92037
VANCOUVER I.
C. BLANCO
C. MENDOCINO
DAVIDSON
PT. CONCEPTION
SAN JUAN
SHOWBOAT
GUADALUPE I.
ERBEN BK.
50°
45°
40°
35°
30°
135°
130°
125°
120°
115°
46
48
50
52
54
56
58
60
62
64
66
68




May 16-31, 1970
Part II, Supplement 2
Sea-surface Temperature °F.,
CALIFORNIA FISHERY MARKET NEWS
MONTHLY SUMMARY - MAY
U.S. DEPARTMENT OF THE INTERIOR
Fish and Wildlife Service
Bureau of Commercial Fisheries
Fishery-Oceanography Center
P.O. Box 271
La Jolla, California 92037
NOTE: Dashed lines indicate positions of 60° and 64° isotherms for 1969.
VANCOUVER I.
C. BLANCO
C. MENDOCINO
DAVIDSON
PT. CONCEPTION
SAN JUAN
SHOWBOAT
GUADALUPE I.
ERBEN BK.
48
50
52
54
56
58
60
62
64
66
68
51
53
52
50
53
62
50°
45°
40°
35°
30°
135°
130°
125°
120°
115°
60°
1969
64°
1969